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RECORDING MEDIUM CARTRIDGE AND
SIGNAL RECORDING APPARATUS

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DESCRIPTION OF THE PRIOR ART

The present invention relates to a disk-shaped, recording 5
medium housed in a cartridge, and a signal recording
apparatus using such a cartridge.

Today's computers and other information equipment
commonly use optical disks to meet their large memory
capacity requirements. A conventional optical disk cartridge 10
is explained below with reference to the drawings.

FIG. 12 depicts a cartridge 31 housing a recording
medium 32, and having an opening window 33 through
which a signal can be recorded onto the medium 32 when the
cartridge 31 is mounted on a signal recording apparatus. The 15
shutter 34 closes the opening window 33. Mounting the
cartridge 31 to the signal recording apparatus automatically
moves the shutter 34 and exposes the opening window 33.

Since the conventional cartridge 31, housing the disk 32,
must record a desired signal accurately, the disk 32 must be 20
protected from contaminants, such as dust or fingerprints,
and from other defects, such as scratches. Such a fixed-disk
structure, therefore, cannot allow a user to remove the disk
32 from its cartridge and mount it to another signal regen- 25
erating apparatus. Even if the disk 32 was removable,
however, the user would not be able to identify whether the
disk 32 was present in the cartridge 31, nor recognize
whether the disk 31 was contaminated with dust or
fingerprints, or damaged by defects. 30

If such contamination or defects go unrecognized, the
signal recording apparatus, when accessing a defective loca-
tion on the disk, will record the signal in error. A signal
recording apparatus can be equipped with a defect detection
feature which would allow it to skip defective locations on 35
the disk, however, such a feature reduces recording appa-
ratus performance, and prohibits the apparatus from record-
ing signals at high speed.

It is therefore an object of the present invention to allow
a user to recognize whether the disk housed in a cartridge 40
has been taken out of the cartridge, and the signal recording
apparatus housing the cartridge can record a signal without
accessing a defective place, caused when the disk was
removed from the cartridge, on the disk.

SUMMARY OF THE INVENTION 45

The disk cartridge of the present invention is directed to
a disk cartridge that allows the user to access the disk housed
in the cartridge.

In one embodiment of the disk cartridge according to the 50
present invention, a cartridge is structured such that a
recording apparatus can record a signal onto a medium when
the cartridge is mounted on the recording apparatus. The
cartridge houses a recording medium, and includes an open-
ing through which the medium can be removed from the 55
cartridge. An indicator on the cartridge informs the user as
to whether the recording medium may have been removed
from the cartridge.

In a second embodiment of the disk cartridge of the
present invention, the cartridge houses a recording medium, 60
and comprises at least one window or opening for recording
a signal onto the medium when the cartridge is mounted on
the signal recording apparatus. The cartridge includes an
opening through which the medium can be removed from
the cartridge, a shutter which covers the opening and an 65
indicator which informs the user as to whether the medium
may have been removed from the cartridge.

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FIG. 2 (a) through FIG. 2 (d) depict a process of removing the recording medium 2 from the cartridge 1.

FIG. 2 (a) shows the cartridge 1, having the cartridge body 6 with the cover 5 and adhesive tape 4 in their original condition as received by the user. FIG. 2 (b) depicts the cartridge 1 with the adhesive tape 4 removed from the cartridge body 6. Removing the adhesive tape 4 allows the user to remove the cover 5, as illustrated in FIG. 2 (c). In this first embodiment, a latch 9 is disposed on each end of the cover 5, and each latch 9 snaps into a receptor 10 in the cartridge body 6. FIG. 2 (d) depicts the recording medium 2 when removed from the cartridge body 6.

The structure of this first embodiment enables either the cover 5 or the cartridge body 6 to indicate that the adhesive tape 4 has been removed, and that the recording medium 2 may have been removed from the cartridge body 6. In other words, changing the condition of adhesive tape 4 from solid adhesion to both the cartridge body 6 and the cover 5, to a peeled off condition allows the recording medium 2 to be removed from the cartridge body 6. For example, as illustrated in FIGS. 3 (a) and (b), when the adhesive tape 4 is peeled off, a portion of the tape 4 remains on the cartridge body 6 and cover 5, and forms the letters "OPEN" to indicate that the adhesive tape has been peeled off. The user may thereby determine that the cartridge 1 has been opened and that the recording medium 2 may be contaminated with dust and/or fingerprints, or it may have some other defects.

FIG. 1 shows that two sheets of adhesive tape 4 are used, however, the number of sheets may vary. Additionally, the message appearing when the adhesive tape 4 is peeled off is not limited to "OPEN." The only requirement is that the user be able to identify that the adhesive tape 4 has been peeled off indicating that the recording medium 2 may have been removed from the cartridge body 6.

A second embodiment of the cartridge of the present invention is described as follows with reference to the drawings, wherein like or corresponding reference numerals are used for like or corresponding parts throughout the several views.

Referring to FIG. 4, a first window 11 in cartridge body 6 is used for recording a signal onto the recording medium 2 when the cartridge 1 is mounted on the signal recording apparatus. A second window 12 is provided in the cartridge body 6, on the opposite side of the first window 11, and has approximately the same shape as the first window 11. The second window 12 is used for recording a signal onto the recording medium 2 when the cartridge 1 is mounted on the signal recording apparatus. An opening 13 is provided at an end of the cartridge body 6 for removing the recording medium from the cartridge 1. A claw 14 is provided as an indicator as to whether the cartridge 1 has ever been opened. As shown in FIG. 5, the claw 14 is connected to the cartridge body 6 by a connectors 15. In the normal usage, as long as the connectors 15 join the claw 14 to the cartridge body 6, the claw 14 prevents the cover 16 from moving or rotating. The cover 16 seals the opening 13 and prevents the removal of the recording medium 2 while the cover 16 is in the closed position, as shown in FIG. 4.

A hinge 17 is mounted to the cartridge body 6, and a first end of the cover 16 is pivotally mounted to the cartridge body 6 at the hinge 17. A second end of the holder 16 includes a latch 18, which engages a receptor 19 of the cartridge body 6, and thereby locks the cover 16 in the closed position.

FIG. 6 (a) through FIG. 6 (c) depict a procedure for removal of the recording medium 2 from the cartridge 1 of the second embodiment.

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FIG. 6 (a) depicts the cartridge body 6 with the cover 16 in the closed or sealed position. The user receives the cartridge 1 in this condition, with the recording medium never having been removed from the cartridge 1.

5 FIG. 6 (b) depicts the cartridge 1 with the claw 14 removed. To remove the claw 14, the user cuts the connectors 15 which releases the claw 14 from the cartridge body 6. With the claw 14 removed, the cover 16 can be rotated about the hinge 17 which opens the window 13 for access to
10 the recording medium 2, as illustrated in FIG. 6 (c). The recording medium 2 may then be removed from the cartridge body 6 through the window 13.

The above structure only allows the user to remove the recording medium 2 from the cartridge 1 when the claw 14
15 is removed. The claw 14 thereby serves as an indicator for determining whether the recording medium 2 may have been removed from the cartridge 1. When the connectors 15 have been cut and the claw 14 removed, the user can recognize that the recording medium may have been removed from the
20 cartridge 1, and the user can expect that the recording medium 2 may be contaminated with dust and/or fingerprints, or it may have some defects.

Additionally, since the opening 13, for accessing the recording medium 2, is located on a different face than the
25 first window 11 and the second window 12 a signal recording apparatus handling the cartridge requires no special structure for regenerating a signal from both sides of the disk. In this second embodiment, the first window 11 and the
30 second window 12 are provided for recording and regenerating a signal to/from both sides of the recording medium 2. When either side of the disk is used, however, or only one side of the disk is used, it is sufficient to provide one window.

In either the first or second embodiment, the cover 5 or 16
35 can be removed from the cartridge body 6, however, as shown in FIG. 7 (b), the cover 5 or 16 may remain joined with the cartridge body 6, by hinges 28 as long as the recording medium 2 can be removed from the cartridge 1.
40 FIG. 7 (a) illustrates the cover 5 as mounted to the cartridge body 6, and FIG. 7 (b) illustrates the cover 5 partially removed from the cartridge body 6.

A third embodiment, providing a signal recording apparatus which handles the cartridge of the present invention, is
45 described as follows with reference to the drawings, wherein like or corresponding reference numerals are used for like or corresponding parts throughout the several views.

Referring to FIG. 8, a detector 20 detects either the adhesive tape 4 or the claw 14, and thereby determines
50 whether the recording medium 2 has possibly been removed from the cartridge 1. If the detector identifies that the recording medium 2 has possibly been removed from the cartridge 1, a searcher 21 searches for defective or non-recordable locations on the recording medium 2. The
55 recorder 22 records signals onto the recording medium 2 via the head 23, and the searcher 21 searches for defects on the recording medium 2 via the head 23.

The detector 20 corresponding to the cartridge of the first embodiment with reflective silver tape, as shown in FIGS. 9
60 (a) and (b), comprises a luminous element 24 which emits a beam of light directed at the adhesive tape on the cartridge 1, and a light receiving element 25 which receives reflected light therefrom.

FIG. 9 (a) depicts a case where the recording medium 2
65 has never been removed from the cartridge 1, and thus the adhesive tape 4 remains in place. Emitted light from the luminous element 24 reflects off the adhesive tape 4 and is

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received by the light receiving element 25. The detector 20 determines that the received light exceeds a threshold level, which indicates that the adhesive tape 4 has not been removed and thus the recording medium 2 has never been removed from the cartridge 1.

FIG. 9 (b) depicts a case where the recording medium 2 has possibly been removed from the cartridge 1. When the adhesive tape 4 is no longer on the cartridge 1, a minimal amount of light is reflected from the luminous element 24 to the receiving element 25. The detector 20 determines that the received light does not exceed the threshold level, which indicates that the adhesive tape 4 is not present and thus the recording medium 2 has possibly been removed from the cartridge 1.

As mentioned above, the adhesive tape 4 need not be of a reflective color, for example a light absorbing color like black may be used. In the instance that a light absorbing color is used, the adhesive tape 4 would absorb a portion of the light emitted from the luminous element 24 and the receiver 25 would thus receive a reduced level of reflected light. The detector 20 determines that the received light is below a threshold level, which indicates that the adhesive tape 4 has not been removed and thus the recording medium 2 has never been removed from the cartridge 1.

Another example comprises an adhesive tape material with different reflective properties than that of the cartridge body 6 and cover 5. Accordingly, a different amount of light emitted from the luminous element 24 would be reflected from the adhesive tape 4 than from the cartridge body 6 and cover 5. The detector 20 of the signal recording apparatus detects the level of light reflected from the cartridge body 6 and cover 5, and determines whether the adhesive tape has been removed from the cartridge 1.

The detector 20 corresponding to the cartridge of the second embodiment with the claw 14, as shown in FIGS. 10 (a)-(d), comprises a switch 26 which detects the presence of the claw 14.

FIGS. 10 (a) and 10 (b) depict a situation where the recording medium 2 has never been removed from the cartridge 1. The switch 26 moves upward from an idle position, as shown in FIG. 10 (a), to an operational, as shown in FIG. 10 (b). The switch 26 contacts the claw 14 which compresses the switch. The detector 20 thereby identifies that the disk claw 14 is present, which indicates that the recording medium 2 has never been removed from the cartridge 1.

FIGS. 10 (c) and 10 (d) depict a situation where the recording medium 2 has possibly been removed from the cartridge 1. The detector 20 moves upward from the idle position and enters the hole from where the claw 14 has been removed. The switch 26 does not compress, and the detector 20 thereby identifies that the disk claw 14 is not present, which indicates that the recording medium 2 has possibly been removed from the cartridge 1.

The recording apparatus of this third embodiment, as described above and illustrated in FIG. 8, operates as follows. In the case where the recording medium 2 has never been taken out of the cartridge 1, the searcher 21 does not search for defective places on the recording medium 2, and the recorder 22 records the signal through the head 23. In the case where that the recording medium 2 has possibly been removed from the cartridge 1, either the searcher 21 searches for defective places on the recording medium 2, and the recorder 22 records the signal onto the recording medium 2, skipping the defective locations, or the recorder 22 prohibits the recording of the signal onto the recording medium 2.

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without searching for defective locations. The recording apparatus thereby records a signal onto the recording medium 2 without accessing defective locations and thus increases the reliability and speed of the recording process.

5 A fourth embodiment, providing an electronic apparatus which handles the cartridge of the present invention, is described as follows with reference to the drawings, wherein like or corresponding reference numerals are used for like or corresponding parts throughout the several views.

10 Referring to FIG. 11, a display 27 (e.g. a CRT or LCD) displays a status regarding the amount of recordable and/or non-recordable space on the recording medium 2, as determined by the searcher 21. The display 27 may be separate from, but connected directly or indirectly to, the signal
15 recording apparatus, or may be incorporated therein.

The electronic apparatus of this fourth embodiment, as illustrated in FIG. 11, operates as follows. In the case where the recording medium 2 has never been taken out of the
20 cartridge 1, the searcher 21 does not search for defective places on the recording medium 2, and the display 27 displays the normal recording capacity of the recording medium 2. In the case where that the recording medium 2 has possibly been removed from the cartridge 1, however,
25 the searcher 21 searches for defective places on the recording medium 2, and the display 27 displays the status of the search results indicating the recordable capacity and/or non-recordable capacity of the recording medium 2. Displaying this information on the display 27 gives a user notice
30 of the recordable capacity of the recording medium 2.

A preferred embodiment of the searcher 21 operates by recording an information signal over the entire recording medium 2, and then regenerating the information signal as recorded. The information signal includes an error correction code, and an error can be detected when the information
35 signal is regenerated. When a detected error cannot be corrected, or it can be corrected but it exceeds a specified error range, the sector where the error occurs is not recordable, and the information that the sector cannot be
40 used is recorded at a specified place on the recording medium 2. The recorded information regarding defective sectors can also be displayed on the display 27 to inform the user regarding the recordable capacity of the recording medium 2. This operation is available also for each track or
45 each sector of the recording medium 2, thereby defective or recordable sectors or tracks can be recorded in the specified place of the recording medium 2 for controlling a recording operation to the recording medium 2.

Where the recording medium 2 is an optical disk, a
50 LASER is used in for recording and regenerating signals. In order to store an information signal on the optical disk in an optimum condition, the acceptable output range of the LASER must be narrow. For example, in the case of a commercialized, recordable optical disk, an optimum output
55 range of the LASER must be within plus or minus 10% of the specified power level. When recording an information signal within this range of LASER output power, the error rate does not exceed the specified range (e.g. not more than 0.00001). When regenerating a recorded information signal,
60 however, the error rate will not exceed the specified range, provided the LASER regenerating power output is within plus or minus 50% of the specified power level. Therefore, it is known that an acceptable range of LASER output power for recording is narrow, while that for regenerating is wide.

65 In other words, once an information signal is recorded, it can be accurately regenerated even if fingerprints, or other defects exist on the optical disk. On the other hand, if